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TWENTY-THIRD ANNUAL CONFERENCE OF STATE UTILITY COMMISSION ENGINEERS

The Twenty-Third Annual Conference of State Utility Commission Engineers was held at the Henry Grady Hotel, Atlanta, Ga., April 25, 26, and 27, under the chairmanship of O. F. Foster, of the Ohio Public Service Commission. Forty-three engineers attended as representatives of 20 States, the District of Columbia, and the Federal Government. The Bureau's representative was Richard L. Lloyd, secretary of the conference.

W. R. McDonald, chairman of the Georgia Public Service Commission, gave the address of welcome, after which the following technical papers were presented: Regulation of intra-state traffic by air carriers, J. G. Hunter, California, (presented by W. B. Westells); Problems involved in the State regulation of transportation utilities in wartime, Guy R. Johnson, Pennsylvania; Original cost and its determination, Guido Moss, Missouri; The prudent investment rate base, W. R. Cobb, Arkansas; A probe into whether the various classes contribute equitably in the support of the utility rate base, E. C. Neusse, Connecticut; Rural electrification in Tennessee, S. J. White, Tennessee;

see: Wall thickness as a factor in the design of a pipe line, K. H. Logan, National Bureau of Standards; Underground storage of gas in the eastern part of the United States, H. J. Wagner, West Virginia; Underground storage of natural gas in the west, W. K. Walker, Oklahoma; Oil for tomorrow—A motion picture in sound and color; Discussion of rural electrification, G. W. Clewley, Vermont; Joint use of property, W. E. Limbocker, Kansas; Rural telephone problems, C. B. Hayden, Wisconsin; The present basis of message toll allocation developed by the Associated Companies, O. S. Vogel, Georgia. At the conference dinner on April 26, the speaker was Carl Wolf, president of the Atlantic Gas Light Co., who touched on some of the present-day problems that confront the utility engineer.

The Executive Committee made up of J. G. Hunter, California (chairman); H. L. Gerrish, Maine (vice chairman); W. Kemp Walker, Oklahoma; S. J. White, Tennessee; J. W. Kushing, Michigan; and R. L. Lloyd, National Bureau of Standards (secretary), appointed a Policy Committee, a Nominating Committee, and a Program Committee for next year, as follows: Policy Committee—C. B. Hayden, Wisconsin (chairman); H. W. Cargo, Nebraska; V. B. Harbryl, Illinois; G. R. Johnson,

¹ Published with approval of the Director of the Budget.

Pennsylvania; W. E. Limbocker, Kansas; and O. S. Vogel, Georgia. Nominating Committee—E. I. Rudd, Connecticut (chairman); G. W. Clewley, Vermont; Guido Moss, Missouri; B. Richardson, Oklahoma; H. J. Wagner, West Virginia; and O. F. Foster, Ohio (ex officio). Program Committee—W. H. Cobb, Arkansas (chairman); Stanley J. White, Tennessee; J. W. Kushing, Michigan; W. B. Wessells, California; and L. B. Curry, Pennsylvania.

At a business meeting of the conference held on April 27, the following items were passed without dissenting vote: (1) That an expression of appreciation be sent by the secretary to the Maine and Georgia commissions for the efforts extended in the entertainment of the 1945 conference; (2) that this year's executive committee appoint an engineering committee to be available for engineering problems that may be presented by the National Association of Railroad and Utilities Commissions; (3) that an invitation be extended to the general solicitor of the NARUC to attend the 1946 Conference of State Utility Commission Engineers.

The chairman of the Executive Committee, O. F. Foster, announced the following as members of the engineering committee to serve as an advisory body to the NARUC: C. B. Hayden, Wisconsin; E. I. Rudd, Connecticut; H. J. Wagner, West Virginia; W. J. Keefe, Massachusetts; and W. B. Wessells, California.

COLOR STANDARDS FOR AVIATION LIGHTS

Airplane operations at night are controlled by radio and lights. So far as it is possible to do the work with lights, the pilot prefers this method because it is more direct. The controlling of flight involves a variety of problems, such as prevention of collision in the air, navigation of aircraft along airways, identification of landing areas, guidance of aircraft along approachway and runway during landing and take-off operations, and direction of aircraft on the ground while taxiing.

Lights for so many purposes must be of different colors. The present colors in use by the Army, Navy, and Civil Aeronautics Administration require the use of two types each of red, yellow, and green, and one type of blue and lunar white, as well as units without colored ware. In order to prevent lights of different colors from being confused, a careful restriction of the variation of the several colors is necessary.

The Bureau has completed the standardization of 14 sets of filters to be used in controlling the colors of aviation lights. These filters were prepared by the Corning Glass Works with the technical assistance of the Bureau. Ten sets of 18 glasses each have been standardized for the Army Air Forces. The remaining sets, which contain 9 filters each, will be used by the Civil Aeronautics Administration. Many of these filters are already in use by inspectors of glass and plastic ware that are being purchased by the Government for use in lights to be mounted on aircraft or set up at landing fields, including some located close to the battle fronts.

SUBSTITUTE MOTOR FUELS

As part of an investigation of substitute motor fuels, conducted at the Bureau for the Foreign Economic Administration of the Office for Emergency Management, a study has been made by Donald B. Brooks of the comparative power, thermal efficiency, and combustion performance of a series of non-hydrocarbon fuels and of a reference gasoline. The nonhydrocarbons, used in forming either neat or blended fuels, included ethyl alcohol, diethyl ether, acetone, and butanol. Tests were made in a precision single-cylinder variable-compression engine, direct-connected to an alternating-current dynamometer, which maintained essentially constant speed.

Tests made at constant compression ratio, simulating the use of these substitute fuels in present engines, designed for operation on gasoline, and giving no more than trace knock on any of the fuels, showed that the power developed by the nonhydrocarbon fuels was from 2 to 5 percent greater than that developed by gasoline. Their thermal efficiencies were slightly higher than that of gasoline at lean mixture ratios. Little difference was noted in the combustion performances of the fuels.

When each fuel was tested at the compression ratio at which it gave trace knock at best-power mixture ratio and optimum spark advance, simulating its use in an engine designed to take full advantage of its antiknock qualities, materially more power and higher thermal efficiencies were developed by the nonhydrocarbon fuels than by gasoline. The power increases ranged up to one-fourth, the highest thermal efficiency being 36 percent, as compared with 28 percent for gasoline. Under these conditions also, the combustion

performances of the fuels were closely related.

The results of these tests are given in detail in the Journal of Research for July (RP1660). They may be summarized by saying that in the absence of knock, the performance of the engine is determined by the specific fuel heat input, without respect to the nature of the fuel furnishing the heat. The knock rating of the fuel governs the compression ratio that may be employed, and thereby determines the power and thermal efficiency that may be obtained.

THERMAL LENGTH CHANGES OF ZIRCONIA

Zirconia (ZrO_2) is obtained from zircon (ZrSiO_4), a mineral which was well known in the early Christian era as the gem stone Hyacinth. Zirconia has been used for some years as an opacifier in enamels, and to some extent in glazes. Its application as a refractory has not been advanced to an appreciable extent, even though it is available in high purity (96 to 99 percent ZrO_2) and at a low cost when compared, for example, with thoria or beryllia. It has a very high resistance to heat (the melting point is believed to be about $2,700^\circ \text{C}$ or possibly higher), it is chemically stable at ordinary and at elevated temperatures, and it is hard (6 on the Mohs scale). Shapes made of zirconia are, however, inclined to disintegrate rather rapidly in service. This disintegration—manifested by progressive cracking until the entire shape has broken up into small, roughly cubical pieces—is caused by large and very rapid changes in volume that accompany the reversible inversions of the low temperature monoclinic form and the tetragonal form of zirconia.

Thermal expansion and differential heating tests showed that the change from monoclinic to tetragonal form during heating, occurs between $1,100^\circ$ and $1,400^\circ \text{C}$ (depending somewhat on the purity of the zirconia), causing the material to shrink and to absorb heat (endothermic reaction). During cooling, the tetragonal reverts to the monoclinic and causes a rapid expansion, beginning sharply at some temperature between 980° and $1,040^\circ \text{C}$ (depending on the purity) and accompanied by an evolution of heat (exothermic reaction).

Published information indicated that the addition of certain oxides to zirconia would alter its crystal form to a "stabilized" cubic lattice, which is not

subject to inversions, and thereby would eliminate the destructive volume changes during heating and cooling. In an investigation by R. F. Geller and P. J. Yavorsky reported in the July Journal of Research (RP1662), the oxides of cerium, yttrium, silicon, magnesium, and calcium were added to zirconia of 99-percent purity, the specimens made of these mixtures were heated at various temperature ranging from $1,450^\circ$ to $1,950^\circ \text{C}$, and the thermal length changes were determined during both heating and cooling between room temperature and a maximum of $1,700^\circ \text{C}$.

The results show that the irregular thermal length changes accompanying phase transformations in zirconia may be prevented by changing the crystal to the stable cubic form. This was accomplished by (a) 11.5- and 15-percent additions of Y_2O_3 and heating at $1,700^\circ$ or higher; (b) 8- and 15-percent addition of MgO and heating at $1,550^\circ$ or higher, though in this case, irregularities were suppressed only for the range from room temperature to $1,200^\circ$; and (c) 5-, 6-, 8-, and 15-percent additions of CaO and heating at $1,550^\circ$ or higher, but additions of more than 6 percent caused the specimens to be very porous and proportionately weak. In all cases, however, the expansion during heating and contraction during cooling were relatively high. Also, zirconia has a low thermal conductivity relative to materials of high thermal expansion, such as alumina, magnesia, and beryllia (unpublished data). Consequently, a high resistance to thermal shock cannot be expected of the stabilized product, even though it is not subject to the structural disintegration characteristics of the commercially pure material.

NEW THERMAL INSULATING MATERIALS

A surprisingly large number of new thermal insulators are arriving at the Bureau for test. These include some new expanded plastics in foam form which weigh not much more than 1 pound per cubic foot. Other materials can be formed in place in irregular spaces. It appears likely that marked practical advances in this development will appear after the war.

TEST CRITERION FOR AN INCOMBUSTIBLE MATERIAL

The term "incombustible" is used in building codes and other regulations and in specifications, often without being defined. An incombustible material

means to the user of the word a material that will not burn under such conditions of exposure as he has in mind. It will not necessarily have the same meaning to others unless those conditions are defined. Thus, most metals will burn under certain conditions, and minor amounts of combustible constituents in an otherwise incombustible material will give it properties inconsistent with those intended when incombustibility is specified.

In a survey of the field of definitions and testing methods made by N. P. Setchkin and S. H. Ingberg, of the Bureau, those adopted by the British Standards Institution appeared most likely to achieve the intended purpose. These are set forth in British Standard 476-1932, "British Standard Definitions for Fire Resistance, Incombustibility and Non-Inflammability of Building Materials and Structures (Including Methods of Test)." By the test method there specified, the sample is heated gradually during the course of $1\frac{1}{2}$ hours in a vertical electrically heated furnace tube up to a temperature of $1,382^{\circ}\text{ F}$ (750° C). Observations are made of occurrence of flame, self-induced glow, or ignition by a pilot flame of gases given off by the specimen.

Tests of a considerable number of materials were made at the Bureau by this method, including asbestos insulations with a maximum of about 10 percent of combustible constituents, acoustical and heating insulating materials with a larger range in combustible content, and samples of magnesium, aluminum, aluminum alloys, tin, and zinc, in a range of particle sizes. The tests were conducted according to the British Standard and also, using the same equipment, by a modified method, involving heating the equipment to the final temperature ($1,382^{\circ}\text{ F}$) before introduction of the sample.

The latter method appeared to give more definite and consistent results. They were in fair concordance with results from tests with larger specimens, such as with the flame-spread tests conducted according to the method given in Federal Specification SS-A-118 for Prefabricated Acoustical Units, although admittedly the latter method does not give well-defined results for materials with low combustible content. As tested by the rising temperature method some insulations would have been classed as "Incombustible" that are known to have ignited and been a source of fire hazard in buildings.

Aluminum of the commercial grade of purity; duralumin; and aluminum alloyed with silicon, and with copper, silicon, and iron were indicated as incombustible by both methods, with samples in particle size down to those passing a No. 325 U. S. Standard Sieve. Ignition was obtained only with an ultrafine grade, of particle size less than 0.001 inch. However, aluminum paint powder having flat particles coated with stearic acid in amounts of 1 and 2 percent of its weight, ignited readily by both methods. This was likewise true of magnesium when samples of particle size from that passing a No. 325 sieve to a single piece $2 \times 1\frac{1}{2} \times \frac{1}{2}$ inch were used. The ignition of tin and zinc was more dependent on particle size and testing method. Ignition of both metals was obtained by the modified method, except in the case of nuggets, chips, and coarse filings retained on a No. 70 sieve. By the British method, the only powders that ignited were those passing the No. 100 or finer sieve and even these did not ignite consistently. Thus, no ignition was obtained with samples of tin and of zinc, each of which passed the No. 200 sieve.

The complete account of this work will appear in the Proceedings of the American Society for Testing Materials.

ACETYL DERIVATIVES OF CERTAIN HEPTOSES, OF GULOSE, AND OF LACTULOSE

The acetyl derivatives of the sugars are among the most important sugar compounds from the standpoint of general usefulness for analytical purposes, in synthesis, and in the elucidation of structure. They are uniquely adapted to the study of the Walden inversion because the configuration of each asymmetric carbon is known, and the positions of the various atoms in space are more or less fixed by the presence of a ring structure. The intimate knowledge of the relative positions of the atoms and groups within the molecule permits experimental confirmation of some of the theories concerning the stereomeric factors necessary for replacement reactions.

In previous publications Harriet L. Frush and Horace S. Ishell, of the Bureau's Polarimetry Section, have shown that cyclic orthoacetates are formed from acetylglucosyl halides when one of the acetyl groups can approach the face of the glycosyl carbon opposite the

halogen. The preparation of a wide variety of acetyl derivatives of the sugars was undertaken in order to obtain additional information concerning the formation of ortho esters and the role of acetyl groups in the replacement reactions of the acetylglycosyl halides. In RP1063 in the Journal of Research for July, the mechanism for the replacement reactions is reviewed briefly by the same authors, and experimental details are given for the preparation of several new acetates of the heptoses, and for acetates of D-gulose, D-glucogalactose, and lactulose. The optical rotations of the new compounds are reported and compared with the optical rotations of related substances.

THERMODYNAMIC PROPERTIES OF 1,3-BUTADIENE

1,3-Butadiene [$\text{CH}_2:\text{CHCH}=\text{CH}_2$] is the major component which, with styrene, is copolymerized to form GR-S (Buna S). This synthetic rubber-like material is being manufactured on a very large scale in Government-financed plants for use in tires and as a general substitute for natural rubber. It is also an important compound in the synthesis of other hydrocarbons and their derivatives.

Experimental work on the thermodynamic properties of 1,3-butadiene has been in progress at the Bureau for several years, and brief preliminary reports of the results have been issued from time to time through the Office of the Rubber Director. A paper by R. B. Scott, C. H. Meyers, R. D. Rands, Jr., F. G. Brickwedde, and N. Bekkedahl appearing in the Journal of Research for July (RP1661) gives a complete description of these experiments and results. The properties investigated include the specific heat of solid and liquid from 15° K to room temperature, the heat of fusion, the triple point, the heat of vaporization at several temperatures, the vapor pressure from -80° to +150° C, the density of the saturated liquid and of the superheated vapor, and the critical constants. By the use of these data, a consistent set of tables of thermodynamic properties was compiled.

EFFECT OF PRESSURE ON THE MELTING OF CRYSTALLINE RUBBER

The effect of hydrostatic pressure on the melting of crystalline rubber has been the subject of a brief investiga-

tion by Lawrence A. Wood, Norman Bekkedahl, and Ralph E. Gibson, extending to pressures above 1,000 atmospheres. With a particular sample of stark rubber, it was found possible to raise the temperature of melting, as determined by the disappearance of birefringence, from about 36° to 70° C by the application of a pressure of 1,170 bars (1.170×10^6 dynes/cm²). The results, including observations at intermediate pressures, can be represented adequately by the equation $\log_{10} (p+1300) = 5.9428 - (875/T)$.

BRAZIL'S RESEARCH FOR INCREASED RUBBER PRODUCTION

It is Brazil's desire to regain her former prominent position as one of the important rubber-producing countries of the world. However, the methods that are used to extract the latex from the wild rubber trees of the jungles of the Amazon Valley and the processes for coagulating the rubber are much too primitive, slow, and costly to compete with the newer methods and more highly developed and cultivated rubber trees of the Far East. Brazil has recently realized that the cultivation of rubber trees in the Amazon Valley is necessary toward the solution of the problem, but that before this could be done much research would have to be performed, because agricultural conditions in the Amazon Valley differ somewhat from those in the Far East.

A leaf disease very harmful to rubber trees is prevalent in South America and must be conquered before plantations can be successful. Brazil has many types of trees that give different types of rubber having different characteristics, and it was apparent that a physicochemical research and testing laboratory would be necessary to evaluate all the various types of rubber. The Brazilian Government, therefore, established, in 1941, a research institution, called the Instituto Agronomico do Norte, near the city of Belem do Para, which is located in the rubber-growing area near the mouth of the Amazon River. The purpose of this institute is to study the problems of botany, pathology, physiology, entomology, technology, and economics connected with all agricultural processes and products of the Amazon Valley. This, of course, includes problems connected with the production of rubber.

This institute, the I. A. N., has been working in close cooperation with the

United States Department of Agriculture and the Bureau in the United States, and also with the Ford Rubber Plantation in Brazil. A tree has been developed that will give a much greater yield of rubber than the average wild rubber tree of the jungle. This tree can also be made resistant to the leaf disease. It is produced by grafting a bud from a tree that is known to give a good yield of latex, to one having a strong root system. This bud is added near the ground and forms the new trunk, the part of the tree that is tapped for latex. Then in order to give the tree good resistance to leaf disease a third strain of tree that is not susceptible to the disease is added by top-budding at a height of 6 or 7 feet to form a new crown. With the development of this improved tree, the I. A. N. expects that the Brazilian Government will finance and begin the planting and cultivating of rubber trees in various sections of the Amazon Valley, and that later small acreages will be turned over to individual natives or families after they have been given sufficient instruction in the improved methods of rubber growing and processing. With a good system of rubber research and technical schools established in the Amazon Valley, Brazil should be able to increase her rubber production and to compete favorably in price and quality with both the natural rubber of the Far East and the synthetic of the United States.

Norman Bekkedahl of the Bureau, who served as the first chief of the Instituto's rubber laboratory (Technical News Bulletin 337, May 1945) has prepared a technical discussion of this subject for publication in "India Rubber World," and a more popular article that will appear in the "Scientific Monthly."

HYDROMETER CORRECTION TABLES AND THERMAL DEN- SITY COEFFICIENTS FOR VEGETAL TABLE TANNING EXTRACTS

As explained in Technical News Bulletin No. 331 (November 1944), barkometer, Twaddle, and Baumé hydrometers are in customary use in the leather-tanning industry. The specific gravity of a tanning extract indicated by the hydrometer is used in conjunction with other data accumulated for that particular extract to measure the strength of the tannins present. The scale of each of the three types of hydrometers

is standard at 60° F. In general, it is impracticable to bring each sample to this temperature before observations are made. The much quicker method of reading the hydrometer at any temperature and applying a correction to obtain the true value at the standard temperature is preferred. In view of the extensive use of hydrometers at tanneries, the American Leather Chemists Association suggested that the Bureau check the barkometer correction table in most common use and prepare tables for barkometer, Twaddle, and Baumé hydrometers.

Observations were made on samples of representative tanning solutions supplied by the Association. The results, in the form of tables for the correction of hydrometer readings made at temperatures between 50° and 100° F in degrees barkometer, in degrees Twaddle, and in degrees Baumé over a range of 1.00 to 1.12 specific gravity, are presented in Circular C449 by Mary Grace Blair and Elmer L. Peffer.

Thermal-density coefficients are also presented in such a way that by their use, the density of a vegetable tanning extract at any temperature within the range of the investigation may be found if its density at 60° F is known.

Copies of this Circular are obtainable from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 10 cents each.

SIMPLIFICATION, AN AID TO MATERIALS HANDLING

The Bureau is alert to the growing Nation-wide interest in simplification as an aid to materials handling. The subject has the attention of key men in many industries. Development of a broad program involves an array of considerations. Adaptability must be achieved among many elements in the distribution structure.

In the Division of Simplified Practice, under the direction of Alvin Hertwig, a project is under way which applies to one aspect—palletizing. Committees representing transportation facilities, materials handling, and the grocery industry have been named. Nomenclature and definitions have been recommended, and a survey of pallet sizes is being made. Although the grocery industry is the first to request the Bureau's cooperation, it is expected that the program will presently include others. A process of evolution is foreseen, however, rather than a mushroom development.

COMMERCIAL STANDARD FOR PREFABRICATED HOUSES

Commercial Standard CS125-45, Prefabricated Homes, which has just been released, is designed to improve the quality of construction for prefabricated dwellings. Although construction methods and materials will vary, this performance standard should serve as a dependable basis for the guidance of purchasers, building inspectors, manufacturers, and mortgagees.

This voluntary standard was proposed in November 1943, by the Prefabricated Home Manufacturers' Institute. A preliminary draft was submitted to a large number of organizations for their review and comment. Following adjustments made in accordance with the consensus of suggestions received, the proposed standard was circulated to all known interested manufacturers, technical organizations, lending agencies, testing laboratories, and building officials, for comment. The standard was then adjusted in accordance with the composite comment and circulated to the trade for written acceptance.

The standard provides minimum requirements for 1-, 1½-, and 2-story prefabricated houses. It covers structural strength of the various component parts, light and ventilation, and recommended requirements for foundations, chimneys, heating, plumbing, insulation, and electric wiring. It includes general requirements for material, workmanship as provided by the manufacturer, erection at site, assembly of prefabricated units, and protection during transportation and erection.

Printed copies of CS125-45 may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 5 cents each.

COMMERCIAL STANDARD FOR GRADING OF DIAMOND POWDER

Those who think of diamonds only as gems may be surprised to learn that most of the world's diamond production goes into industrial uses. Diamond is one of the hardest substances known, and this property is utilized in making drills for oil wells, dies for drawing fine wire, and in the manufacture of various tools where sharp cutting edges and durability under very exacting con-

ditions are needed. A substantial percentage of the diamonds for industrial use are ground to a powder and used as an abrasive. Most of the powder is formed into grinding wheels and cutting tools by incorporating the powder in metal. Very fine diamond powder is used as such for cutting and polishing diamonds for gems, and in polishing diamond dies, jewel bearings for watches and other delicate instruments, and for many uses where a durable, fast-cutting abrasive is needed.

The enormous demand for machine tools, wire for electrical purposes, and instrument bearings by war industries has placed a heavy demand on the United Nations' supply of diamond powder. In order to conserve these resources, the War Production Board and the National Research Council inaugurated at the Bureau a study of the methods of production and grading. As the efficient use of diamond powder depends upon accurate grading and uniformity of grain size, emphasis has been placed on grading methods. A system of designating grades of diamond powder was developed whereby the range of particle size within the various grades is specified, the sizes of particles having been ascertained by measuring them under a microscope.

As a thorough understanding among producers and users is essential to the conservation of supplies of diamond for the production of powder, the Miscellaneous Minerals Division of the War Production Board requested the Bureau to cooperate with the trade in establishing a commercial standard. This was developed and subsequently accepted by producers and users representing a satisfactory volume of the business; it became effective for new production from April 5, 1945. The standard covers material, grade designations, grain size and size range, amount of "fines," or particles, smaller than the minimum for each designation, impurities, methods of sampling and inspection, and method of guaranteeing compliance with the standard.

The printed pamphlet, entitled "Grading of Diamond Powder, Commercial Standard CS123-45," includes the complete standard and other information, such as the membership of a standing committee of the industry and a list of acceptors. It is available at 5 cents a copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

NEW AND REVISED PUBLICATIONS ISSUED DURING JUNE 1945

Journal of Research¹

Journal of Research of the National Bureau of Standards, volume 34, number 5, May 1945 (RP1651 to RP1655, inclusive). Price 30 cents. Annual subscription, 12 issues, \$3.50.

Research Papers²

[Reprints from March and April 1945
Journal of Research]

RP1638. Copper reduction of dextrose, levulose, invert sugar, and sucrose-invert-sugar mixtures in citrate-carbonate solution. Richard F. Jackson and Emma J. McDonald. Price 5 cents.

RP1639. Effect of aeration on hydrogenation concentration of soils in relation to identification of corrosive soils. Melvin Romanoff. Price 5 cents.

RP1640. Specific heats of gaseous 1,3-butadiene, isobutene, styrene, and ethylbenzene. Russell B. Scott and Jane W. Mellors. Price 5 cents.

RP1641. Free energies and equilibria of isomerization of the 18 octanes. Edward J. Prosen, Kenneth S. Pitzer, and Frederick D. Rossini. Price 5 cents.

RP1642. Heats of combustion and formation of the paraffin hydrocarbons at 25° C. Edward J. Prosen and Frederick D. Rossini. Price 5 cents.

RP1643. Comparison of the purity of samples of organic solvents by ultraviolet spectrophotometry. Marion E. Maclean, Priscilla J. Jencks, and S. F. Acree. Price 5 cents.

RP1644. Vapor pressure, latent heat of vaporization, and triple-point temperature of N₂O. Harold J. Hoge. Price 5 cents.

RP1646. Photometer for luminescent materials. Ray P. Teele. Price 5 cents.

RP1647. Freezing temperature of benzoic acid as a fixed point in thermometry. Frank W. Schwab and Edward Wichers. Price 10 cents.

RP1648. pH of aqueous mixtures of potassium dihydrogen phosphate and disodium hydrogen phosphate at 0° to 60° C. Roger G. Bates and S. F. Acree. Price 10 cents.

RP1649. Melting point of alpha-alumina. R. F. Geller and P. J. Yavorsky. Price 5 cents.

RP1650. Heats and free energies of formation of the paraffin hydrocarbons, in the gaseous state, to 1,500° K. Edward J. Prosen, Kenneth S. Pitzer, and Frederick D. Rossini. Price 5 cents.

Circular¹

C449. Hydrometer correction tables and thermal-density coefficients for vegetable tanning extracts. Mary Grace Blair and Elmer L. Peffer. Price 10 cents.

Simplified Practice Recommendations²

R207-45. Pipes, ducts, and fittings for warm-air heating and air conditioning. Price 10 cents.

R210-45. Carbon-brush terminals (electric). Price 5 cents.

Commercial Standards²

CS123-45. Grading of diamond powder. Price 5 cents.

CS125-45. Prefabricated homes. Price 5 cents.

Technical News Bulletin²

Technical News Bulletin 338, June 1945. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

C702. Optical instruments, refractometry, and optical properties of glass: Publications by the Staff of the National Bureau of Standards. (Supersedes LC704)

¹ Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, \$3.50 a year (to addresses in the United States and its possessions and to countries extending the franking privilege); other countries, 70 cents and \$4.50, respectively.

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